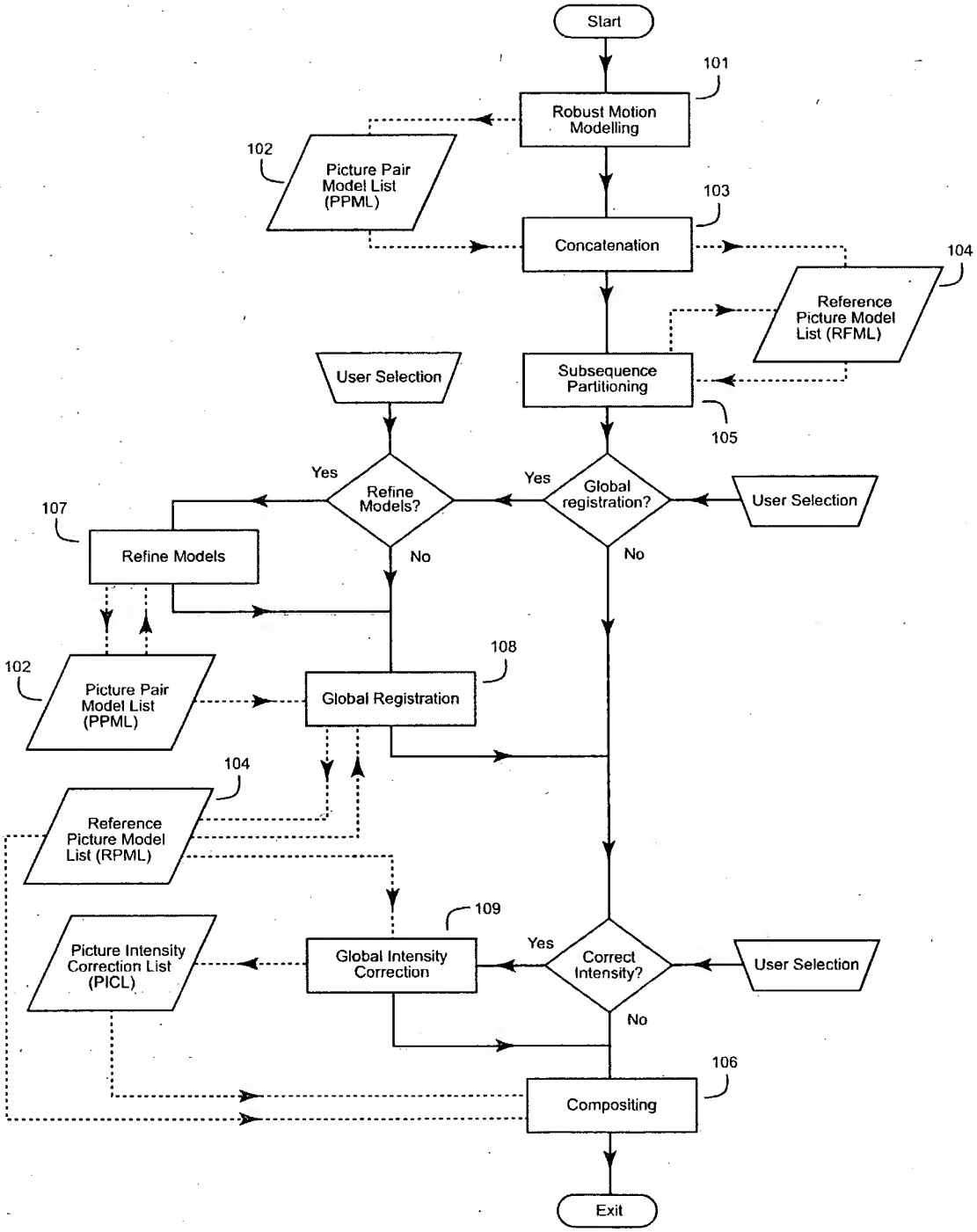

Start
101
Robust Motion Modelling
102
Picture Pair Model List (PPML)
103
Concatenation
104
Reference Picture Model List (RFML)
User Selection
Subsequence Partitioning
105
Yes
Refine Models?
Yes
Global registration?
User Selection
107
Refine Models
No
No
102
Picture Pair Model List (PPML)
108
Global Registration
104
Reference Picture Model List (RPML)
109
Picture Intensity Correction List (PICL)
Global Intensity Correction
Yes
Correct Intensity?
User Selection
No
106
Compositing
Exit

FIG. 1

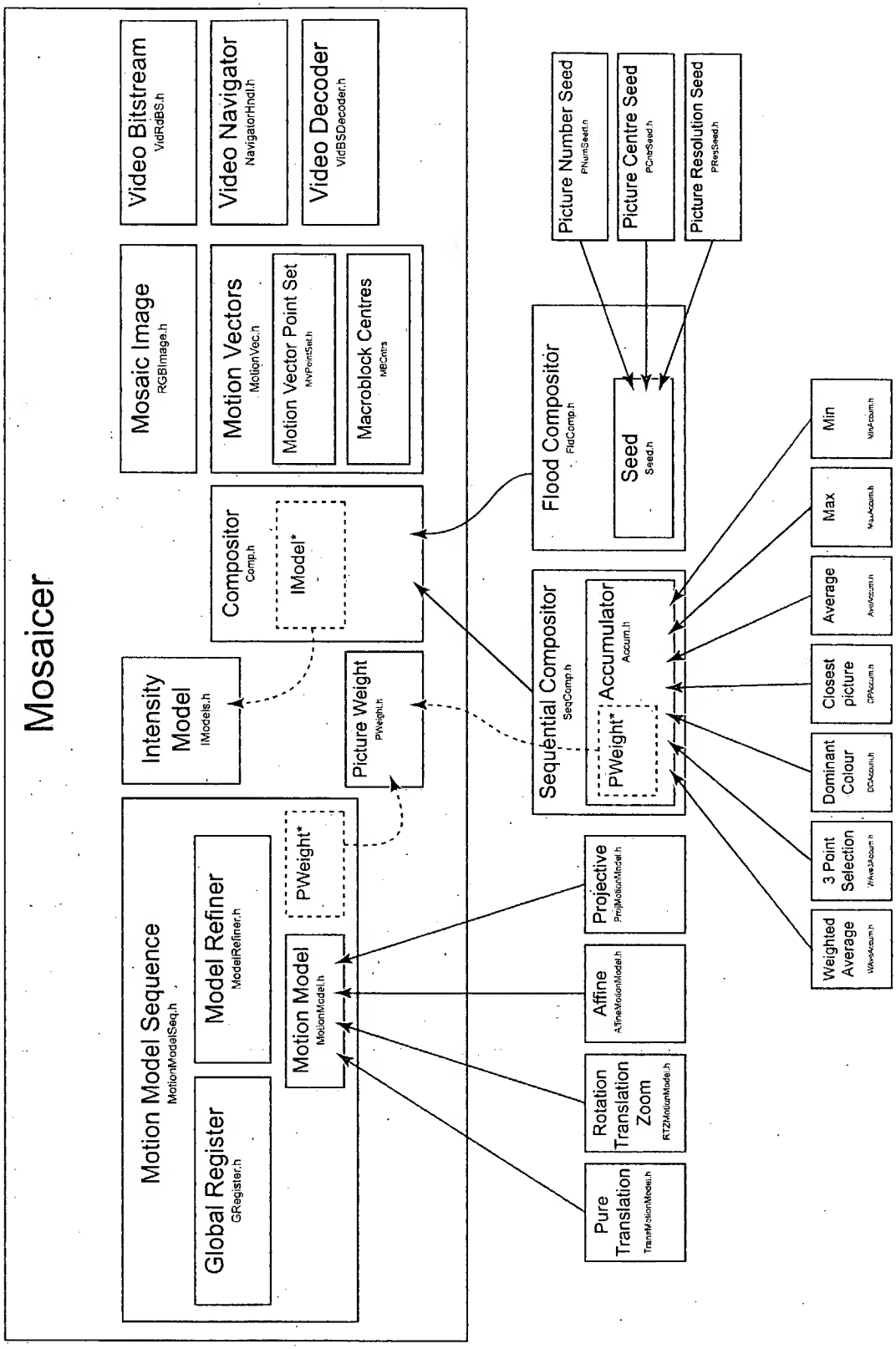

Mosaicer
Video Bitstream
VidRdBS.h
Video Navigator
NavigatorHndl.h
Video Decoder
VidBSDecoder.h
Mosaic Image
RGBImage.h
Motion Vectors
MotionVec.h
Motion Vector Point Set
MvPointSet.h
Macroblock Centres
MBCntrs
Compositor
Comp.h
IModel*
Intensity Model
IModels.h
Picture Weight
PWeight.h
Motion Model Sequence
MotionModelSeq.h
Model Refiner
ModelRefiner.h
Global Register
GRegister.h
Motion Model
MotionModel.h
PWeight*
Pure Translation
TransMotionModel.h
Rotation Translation Zoom
RTZMotionModel.h
Affine
AffineMotionModel.h
Projective
ProjMotionModel.h
Flood Compositor
FldComp.h
Seed
Seed.h
Picture Number Seed
PNumSeed.h
Picture Centre Seed
PCntrSeed.h
Picture Resolution Seed
PResSeed.h
Sequential Compositor
SeqComp.h
Accumulator
Accum.h
PWeight*
Weighted Average
WAveAccum.h
3 Point Selection
W3PtAccum.h
Dominant Colour
DCAccum.h
Closest picture
CPAccum.h
Average
AveAccum.h
Max
MaxAccum.h
Min
MinAccum.h

FIG. 2

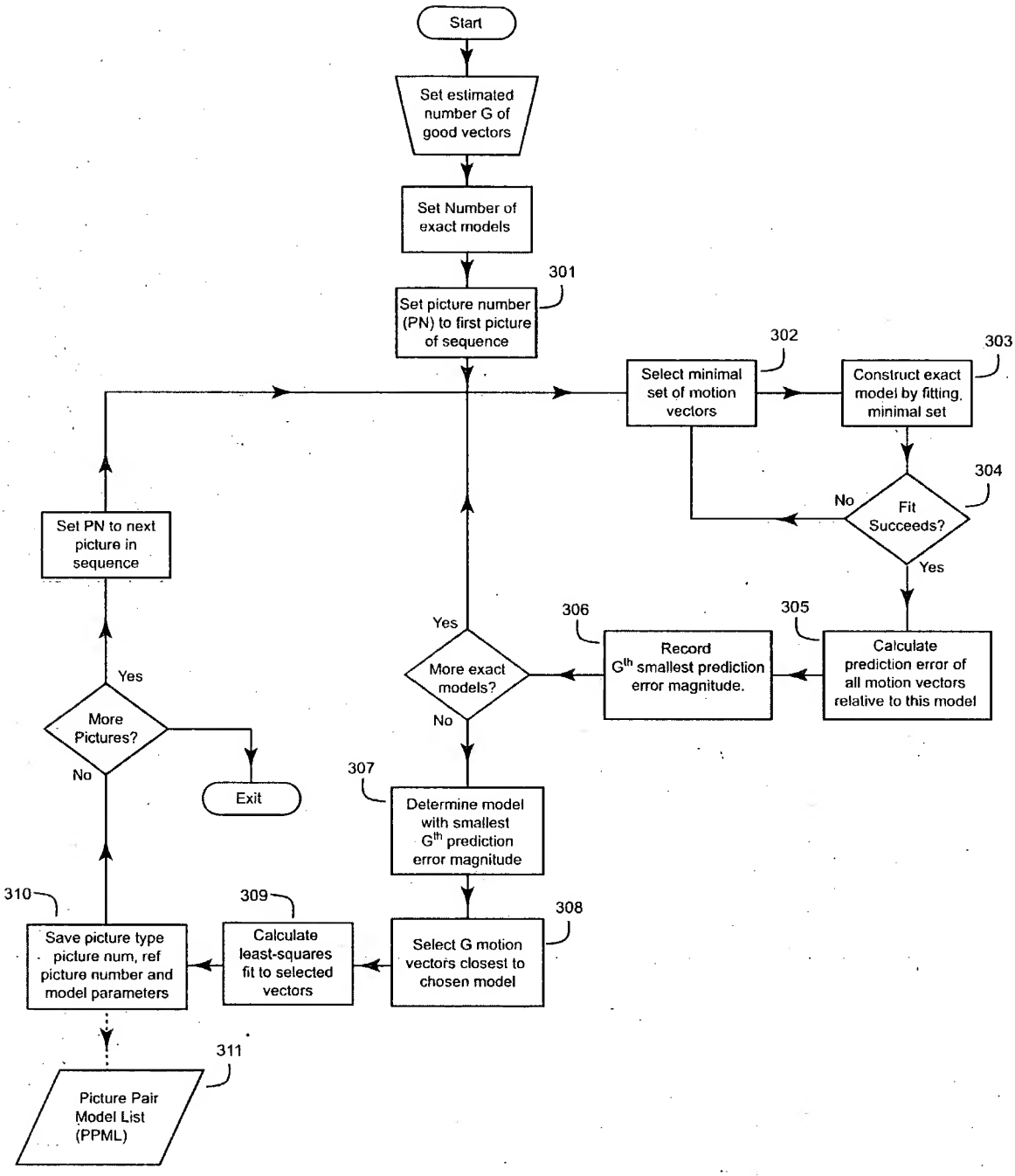

Start
Set estimated number G of good vectors
Set Number of exact models
301
Set picture number (PN) to first picture of sequence
302
Select minimal set of motion vectors
303
Construct exact model by fitting minimal set
304
Fit Succeeds?
No
Yes
305
Calculate prediction error of all motion vectors relative to this model
306
Record G^th smallest prediction error magnitude.
More exact models?
Yes
No
307
Determine model with smallest G^th prediction error magnitude
308
Select G motion vectors closest to chosen model
309
Calculate least-squares fit to selected vectors
310
Save picture type picture num, ref picture number and model parameters
311
Picture Pair Model List (PPML)
More Pictures?
Yes
No
Exit
Set PN to next picture in sequence

FIG. 3

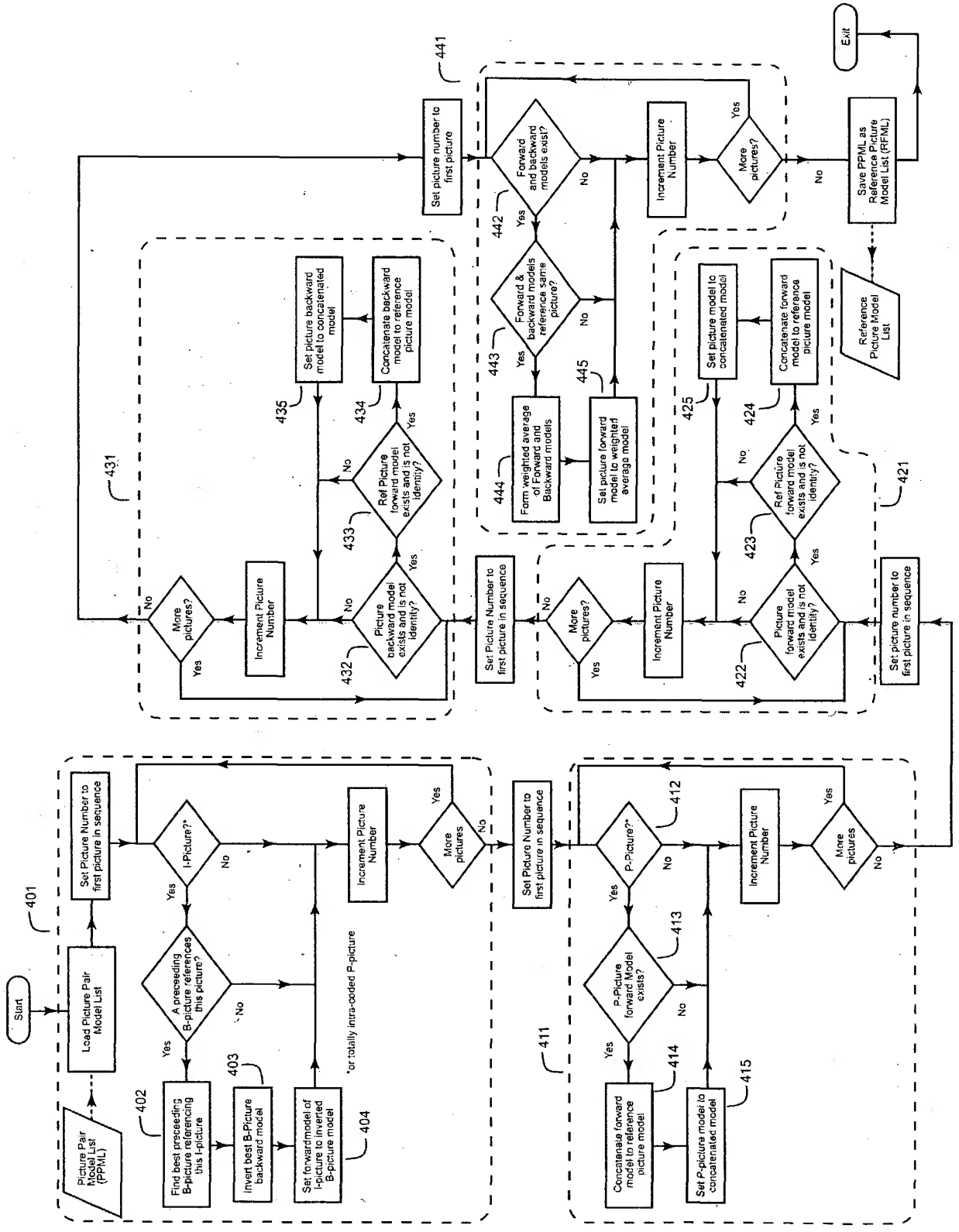
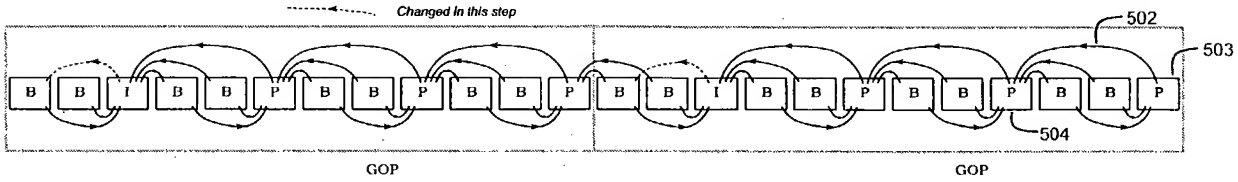

Start
Load Picture Pair Model List
Picture Pair Model List (PPML)
401
Set Picture Number to first picture in sequence
I-Picture?*
Yes
No
A preceeding B-picture references this picture?
Yes
No
402
Find best preceeding B-picture referencing this I-picture
403
Invert best B-Picture backward model
Set forwardmodel of I-picture to inverted B-picture model
404
*or totally intra-coded P-picture
Increment Picture Number
More pictures
Yes
No
Set Picture Number to first picture in sequence
411
P-Picture?*
412
Yes
No
P-Picture forward Model exists?
413
Yes
No
414
Concatenate forward model to reference picture model
415
Set P-picture model to concatenated model
Increment Picture Number
More pictures
Yes
No
Set picture number to first picture in sequence
421
Picture forward model exists and is not identity?
422
Yes
No
423
Ref Picture forward model exists and is not identity?
Yes
No
424
Concatenate forward model to reference picture model
425
Set picture model to concatenated model
Increment Picture Number
More pictures
Yes
No
Set Picture Number to first picture in sequence
431
Picture backward model exists and is not identity?
432
Yes
No
433
Ref Picture forward model exists and is not identity?
Yes
No
434
Concatenate backward model to reference picture model
435
Set picture backward model to concatenated model
Increment Picture Number
More pictures
Yes
No
Set picture number to first picture
441
Forward and backward models exist?
442
Yes
No
Forward & backward models reference same picture?
443
Yes
No
444
Form weighted average of Forward and Backward models
445
Set picture forward model to weighted average model
Increment Picture Number
More pictures
Yes
No
Save PPML as Reference Picture Model List (RPML)
Reference Picture Model List
Exit

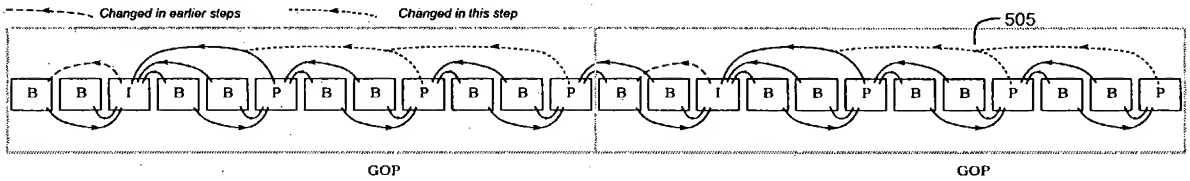
FIG. 4

For each I-picture or intra-coded P-picture which is reference by one of the preceeding B pictures:

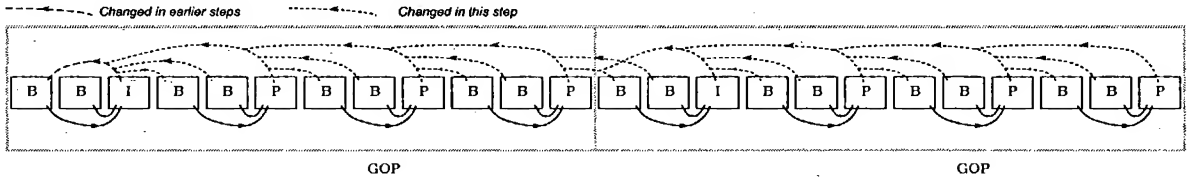
- o look at B pictures whose backward motion model references the I-picture and identify the one which uses the most macroblocks,
- o invert the backward motion model for that B-picture and assign it as a forward motion model



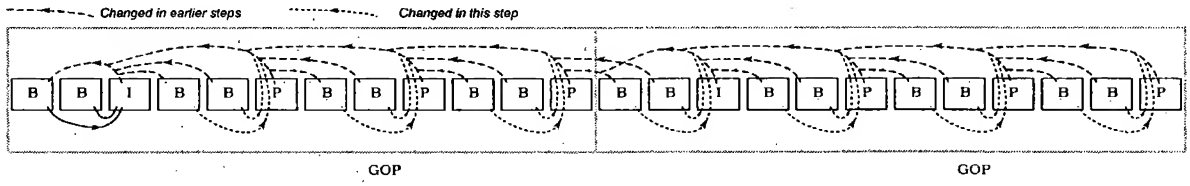

In display order, concatenate all P-picture models where they exist to their reference picture models



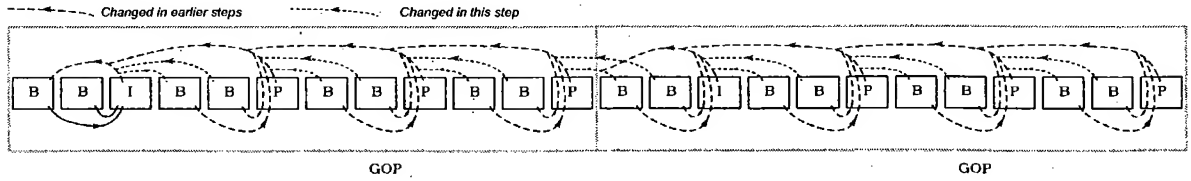

In display order, concatenate the forward models of all pictures (except those with identity forward models or no forward models or whose reference pictures have have identity forward or no forward models) with the forward models of their reference pictures




In display order, concatenate the backward models of all pictures (except those with identity forward models or no forward models or whose reference pictures have have identity forward models or no forward models) with the forward models of their reference pictures.




For each B picture where both forward and backward models exist we have two models. For any B picture with both a backward and a forward motion models which reference the same picture make the forward model parameters equal to the weighted average of the forward and backward model parameters where the weighting is the number of motion blocks contributing to the model squared.




Backward models remain but are ignored in subsequent processing

FIG. 5

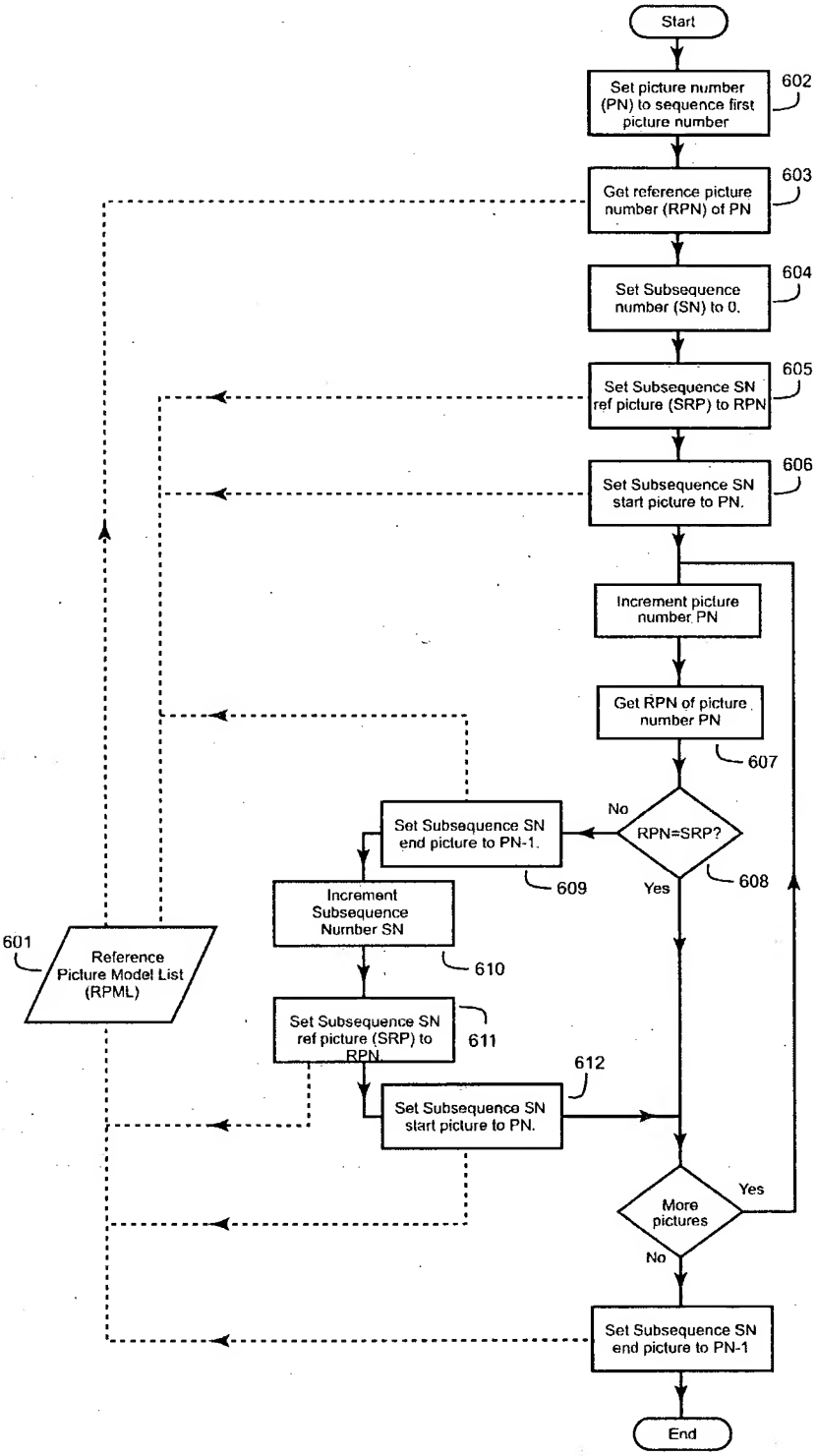

Start
Set picture number (PN) to sequence first picture number
602
Get reference picture number (RPN) of PN
603
Set Subsequence number (SN) to 0.
604
Set Subsequence SN ref picture (SRP) to RPN
605
Set Subsequence SN start picture to PN.
606
Increment picture number PN
Get RPN of picture number PN
607
RPN=SRP?
No
Yes
608
Set Subsequence SN end picture to PN-1.
609
Increment Subsequence Number SN
610
Set Subsequence SN ref picture (SRP) to RPN.
611
612
Set Subsequence SN start picture to PN.
More pictures
Yes
No
Set Subsequence SN end picture to PN-1
End
601
Reference Picture Model List (RPML)

FIG. 6

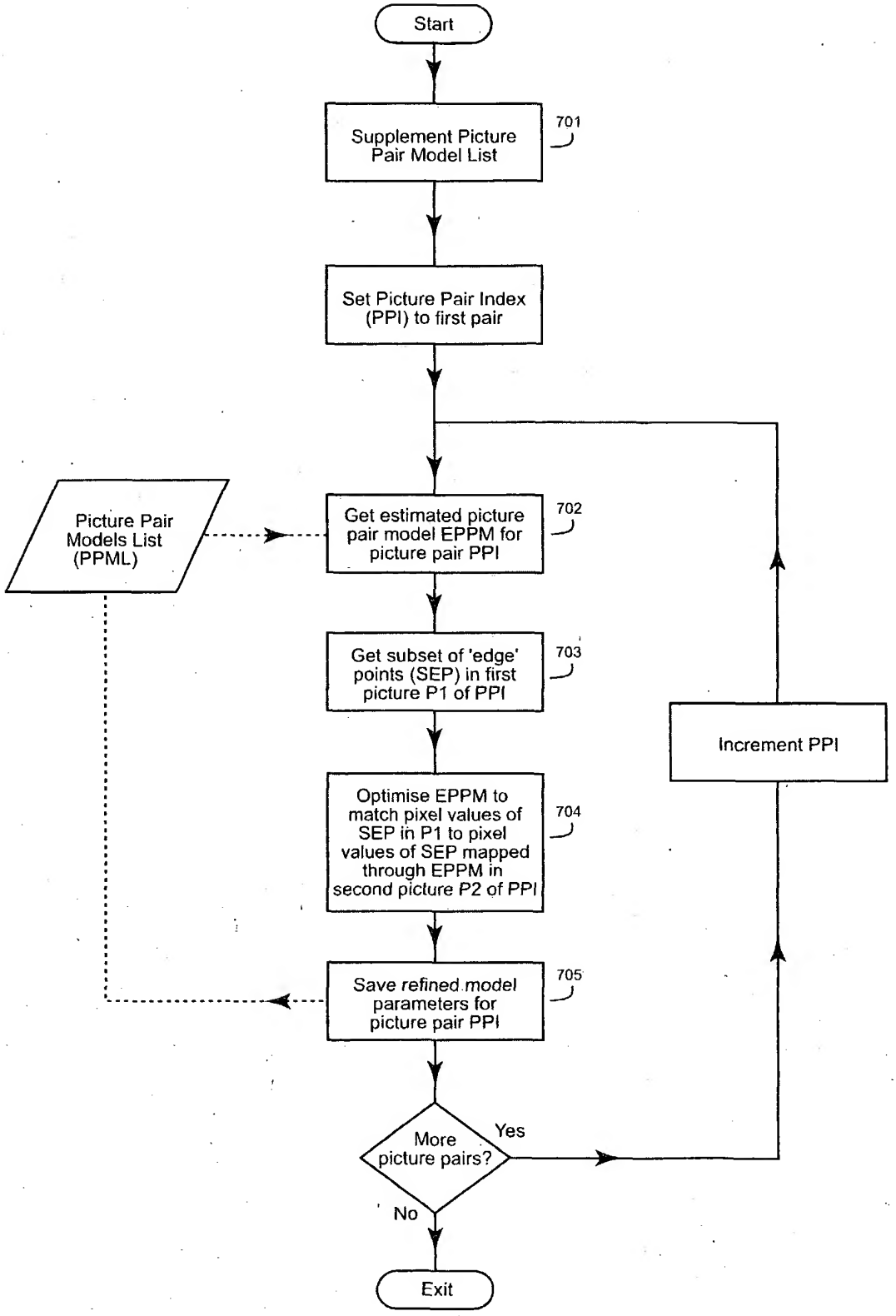

Start
Supplement Picture Pair Model List
701
Set Picture Pair Index (PPI) to first pair
Picture Pair Models List (PPML)
Get estimated picture pair model EPPM for picture pair PPI
702
Get subset of 'edge' points (SEP) in first picture P1 of PPI
703
Optimise EPPM to match pixel values of SEP in P1 to pixel values of SEP mapped through EPPM in second picture P2 of PPI
704
Save refined model parameters for picture pair PPI
705
Increment PPI
More picture pairs?
Yes
No
Exit

FIG. 7

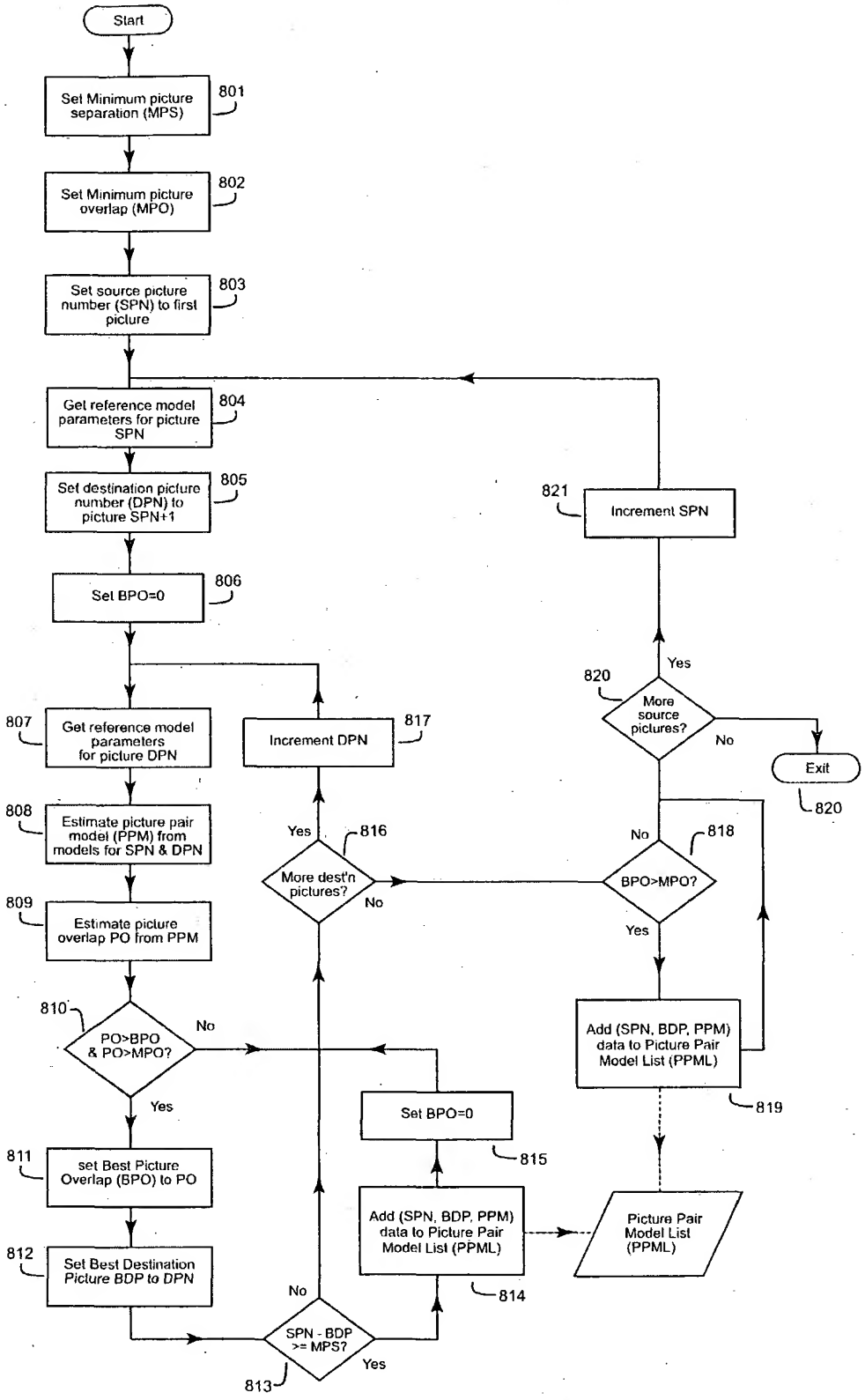

Start
Set Minimum picture separation (MPS)
801
Set Minimum picture overlap (MPO)
802
Set source picture number (SPN) to first picture
803
Get reference model parameters for picture SPN
804
Set destination picture number (DPN) to picture SPN+1
805
Set BPO=0
806
Get reference model parameters for picture DPN
807
Estimate picture pair model (PPM) from models for SPN & DPN
808
Estimate picture overlap PO from PPM
809
PO>BPO & PO>MPO?
810
No
Yes
set Best Picture Overlap (BPO) to PO
811
Set Best Destination Picture BDP to DPN
812
SPN - BDP >= MPS?
813
No
Yes
Add (SPN, BDP, PPM) data to Picture Pair Model List (PPML)
814
Set BPO=0
815
More dest'n pictures?
816
Yes
No
Increment DPN
817
BPO>MPO?
818
No
Yes
Add (SPN, BDP, PPM) data to Picture Pair Model List (PPML)
819
Picture Pair Model List (PPML)
More source pictures?
820
Yes
No
Exit
820
Increment SPN
821

FIG. 8

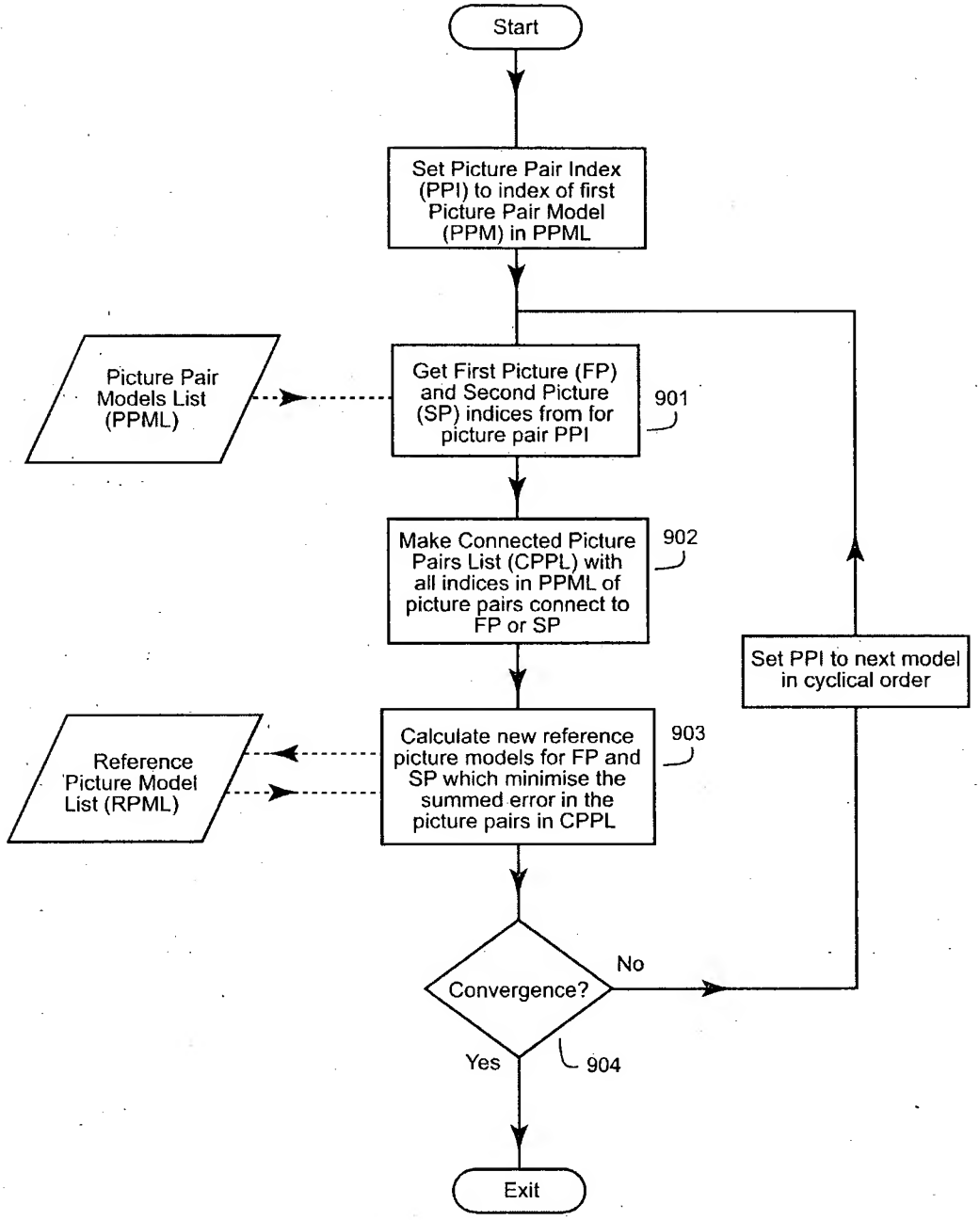

Start
Set Picture Pair Index (PPI) to index of first Picture Pair Model (PPM) in PPML
Picture Pair Models List (PPML)
Get First Picture (FP) and Second Picture (SP) indices from for picture pair PPI
901
Make Connected Picture Pairs List (CPPL) with all indices in PPML of picture pairs connect to FP or SP
902
Set PPI to next model in cyclical order
Reference Picture Model List (RPML)
Calculate new reference picture models for FP and SP which minimise the summed error in the picture pairs in CPPL
903
Convergence?
No
Yes
904
Exit

FIG. 9

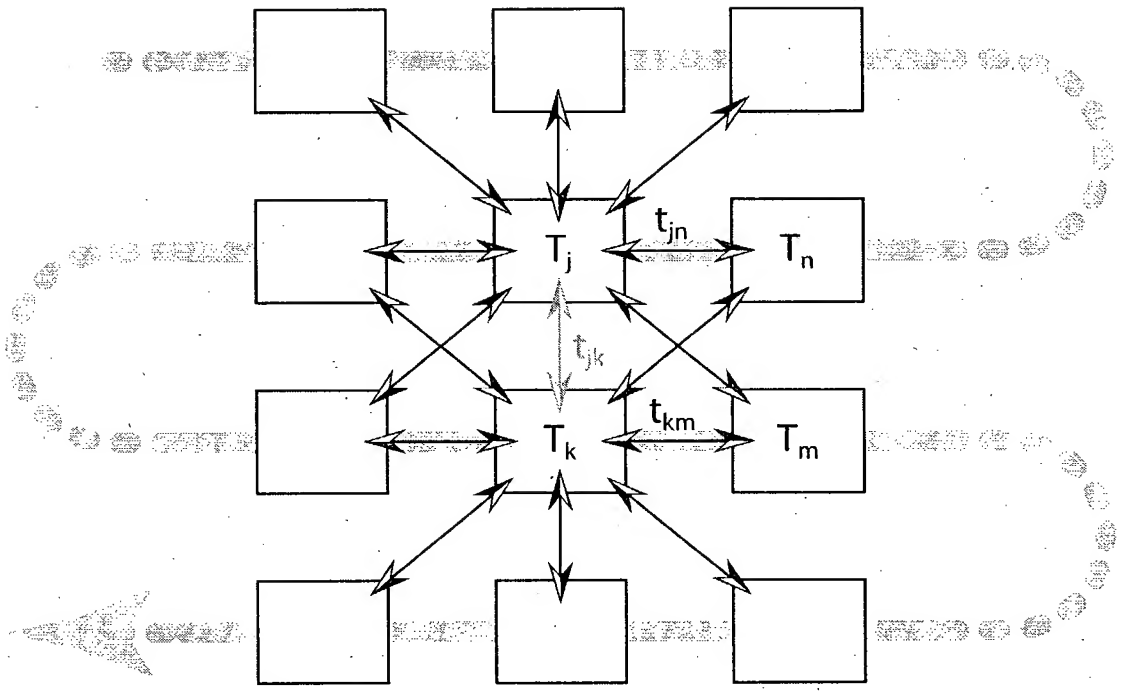



FIG.10

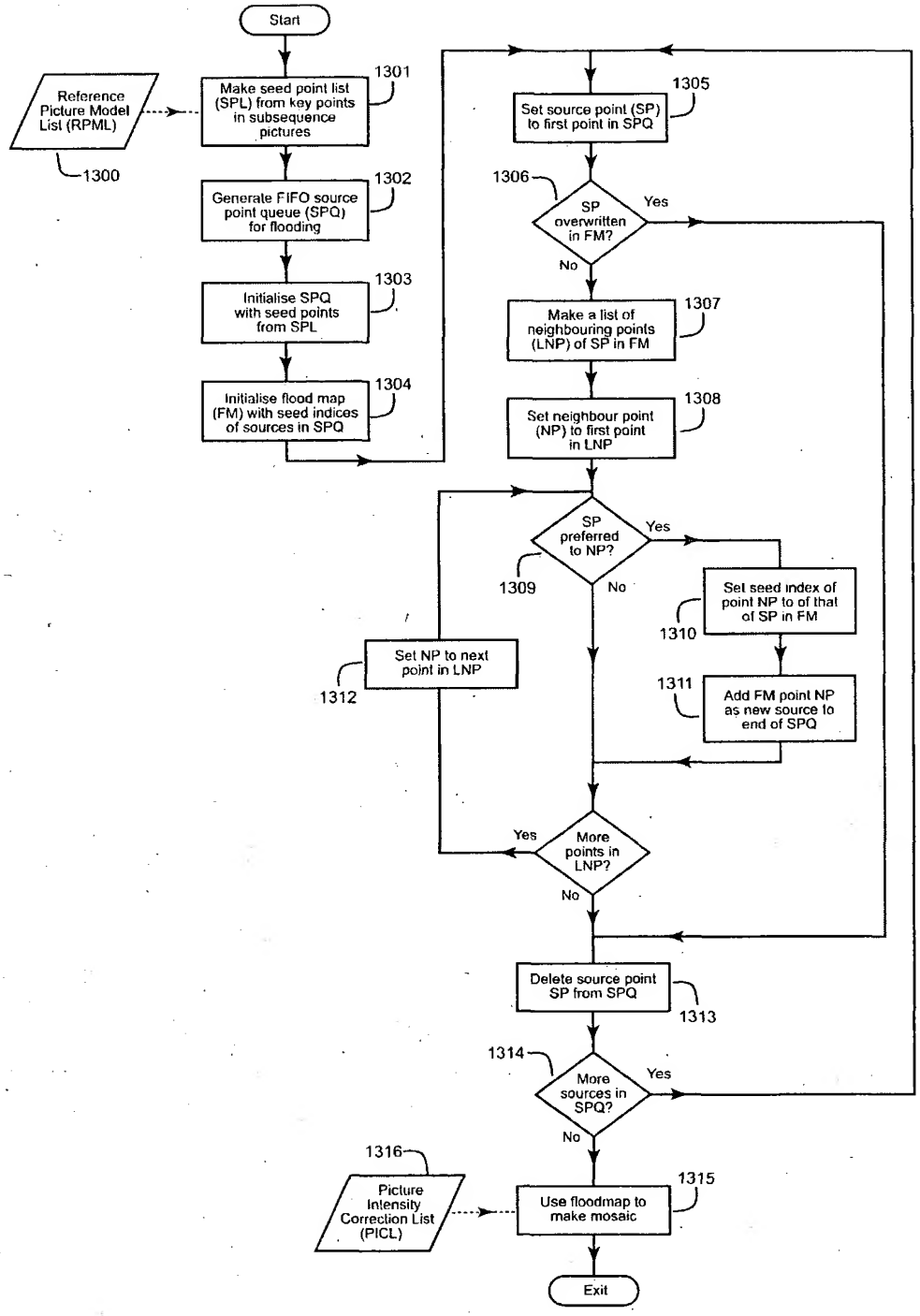

Start
Reference Picture Model List (RPML)
1300
Make seed point list (SPL) from key points in subsequence pictures
1301
Generate FIFO source point queue (SPQ) for flooding
1302
Initialise SPQ with seed points from SPL
1303
Initialise flood map (FM) with seed indices of sources in SPQ
1304
Set source point (SP) to first point in SPQ
1305
SP overwritten in FM?
1306
Yes
No
Make a list of neighbouring points (LNP) of SP in FM
1307
Set neighbour point (NP) to first point in LNP
1308
SP preferred to NP?
1309
Yes
No
Set seed index of point NP to of that of SP in FM
1310
Add FM point NP as new source to end of SPQ
1311
Set NP to next point in LNP
1312
More points in LNP?
Yes
No
Delete source point SP from SPQ
1313
More sources in SPQ?
1314
Yes
No
Picture Intensity Correction List (PICL)
1316
Use floodmap to make mosaic
1315
Exit

FIG.11

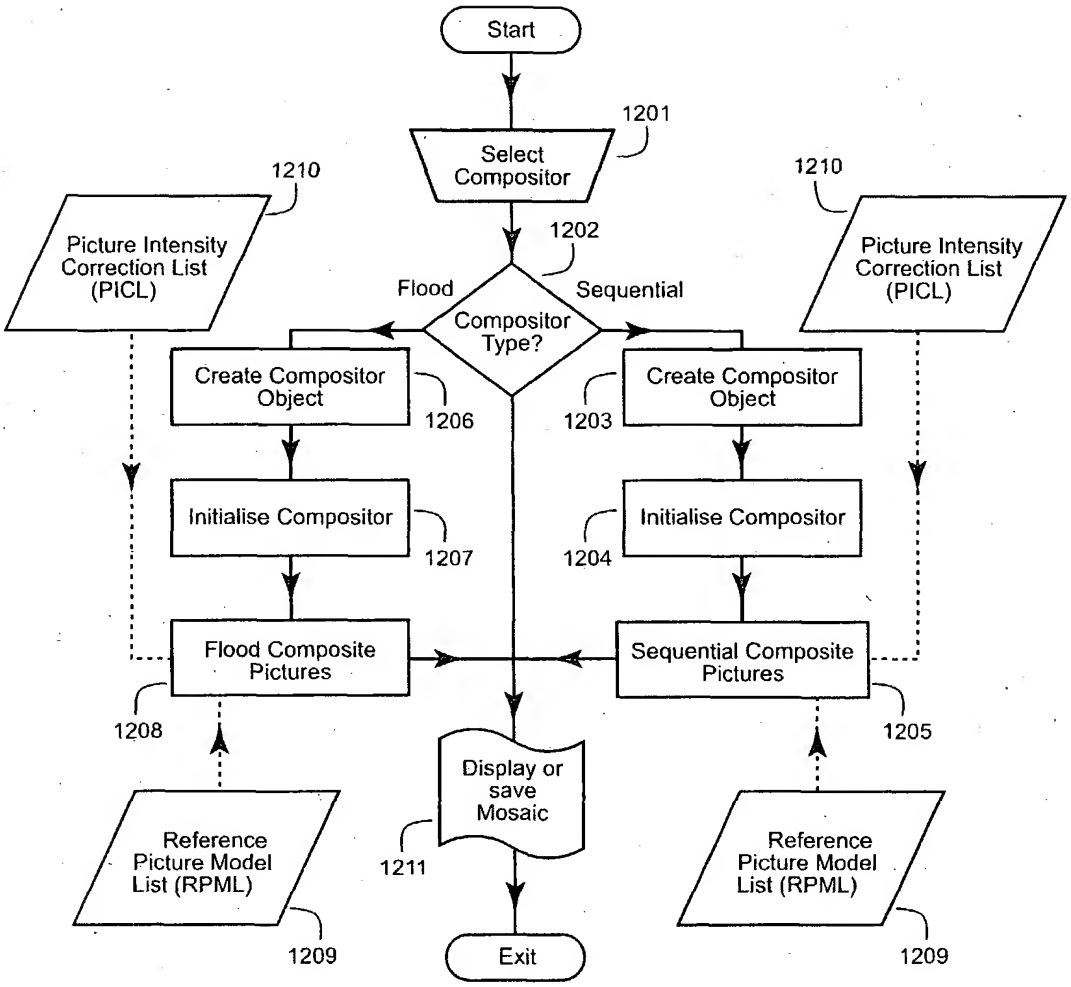

Start
1201
Select Compositor
1210
Picture Intensity Correction List (PICL)
1202
Flood
Sequential
Compositor Type?
1210
Picture Intensity Correction List (PICL)
Create Compositor Object
1206
Create Compositor Object
1203
Initialise Compositor
1207
Initialise Compositor
1204
Flood Composite Pictures
1208
Sequential Composite Pictures
1205
Display or save Mosaic
1211
Reference Picture Model List (RPML)
1209
Reference Picture Model List (RPML)
1209
Exit

FIG.12

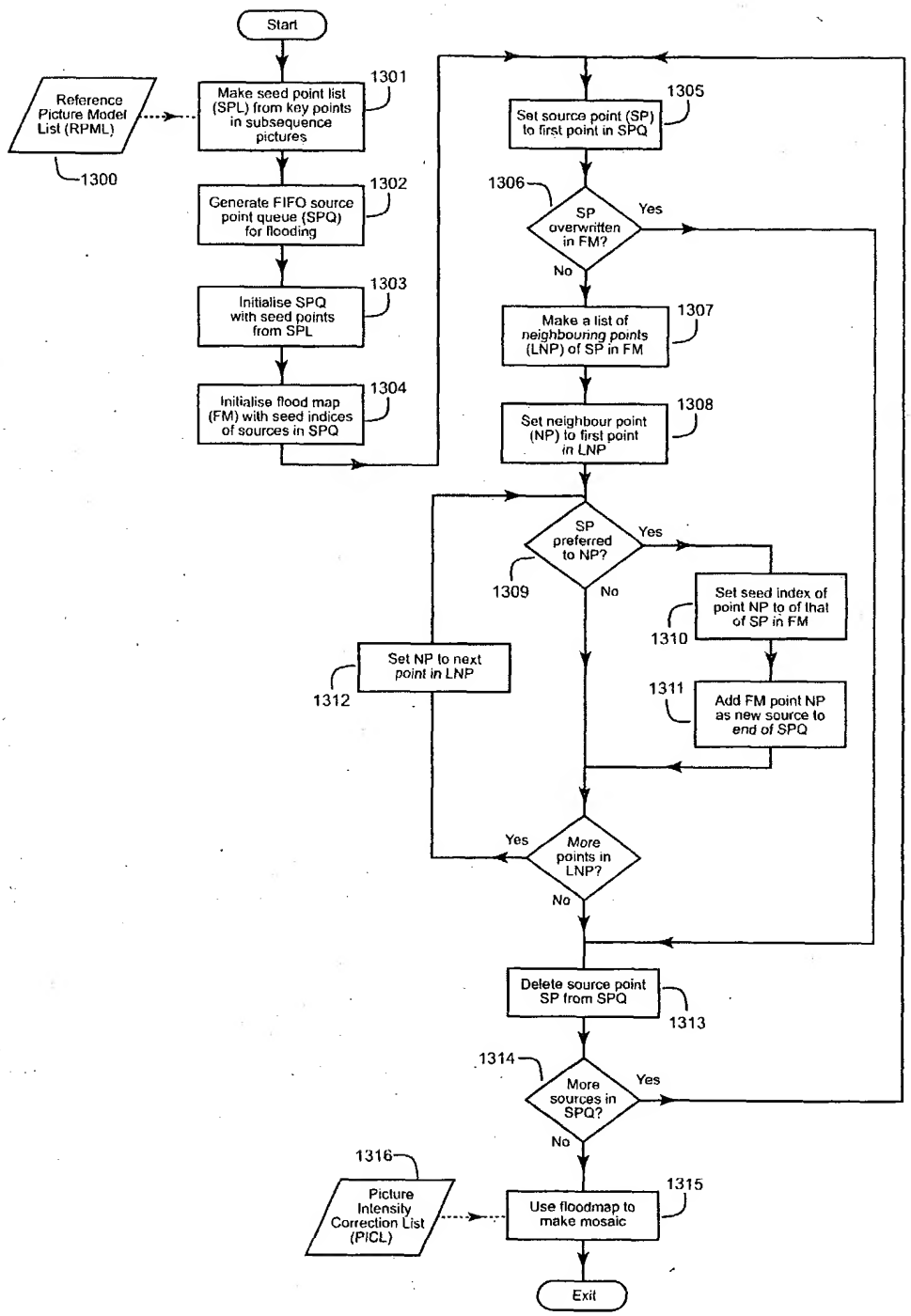

Start
Reference Picture Model List (RPML)
1300
Make seed point list (SPL) from key points in subsequence pictures
1301
Generate FIFO source point queue (SPQ) for flooding
1302
Initialise SPQ with seed points from SPL
1303
Initialise flood map (FM) with seed indices of sources in SPQ
1304
Set source point (SP) to first point in SPQ
1305
SP overwritten in FM?
1306
Yes
No
Make a list of neighbouring points (LNP) of SP in FM
1307
Set neighbour point (NP) to first point in LNP
1308
SP preferred to NP?
1309
Yes
No
Set seed index of point NP to of that of SP in FM
1310
Add FM point NP as new source to end of SPQ
1311
Set NP to next point in LNP
1312
More points in LNP?
Yes
No
Delete source point SP from SPQ
1313
More sources in SPQ?
1314
Yes
No
Picture Intensity Correction List (PICL)
1316
Use floodmap to make mosaic
1315
Exit

FIG.13

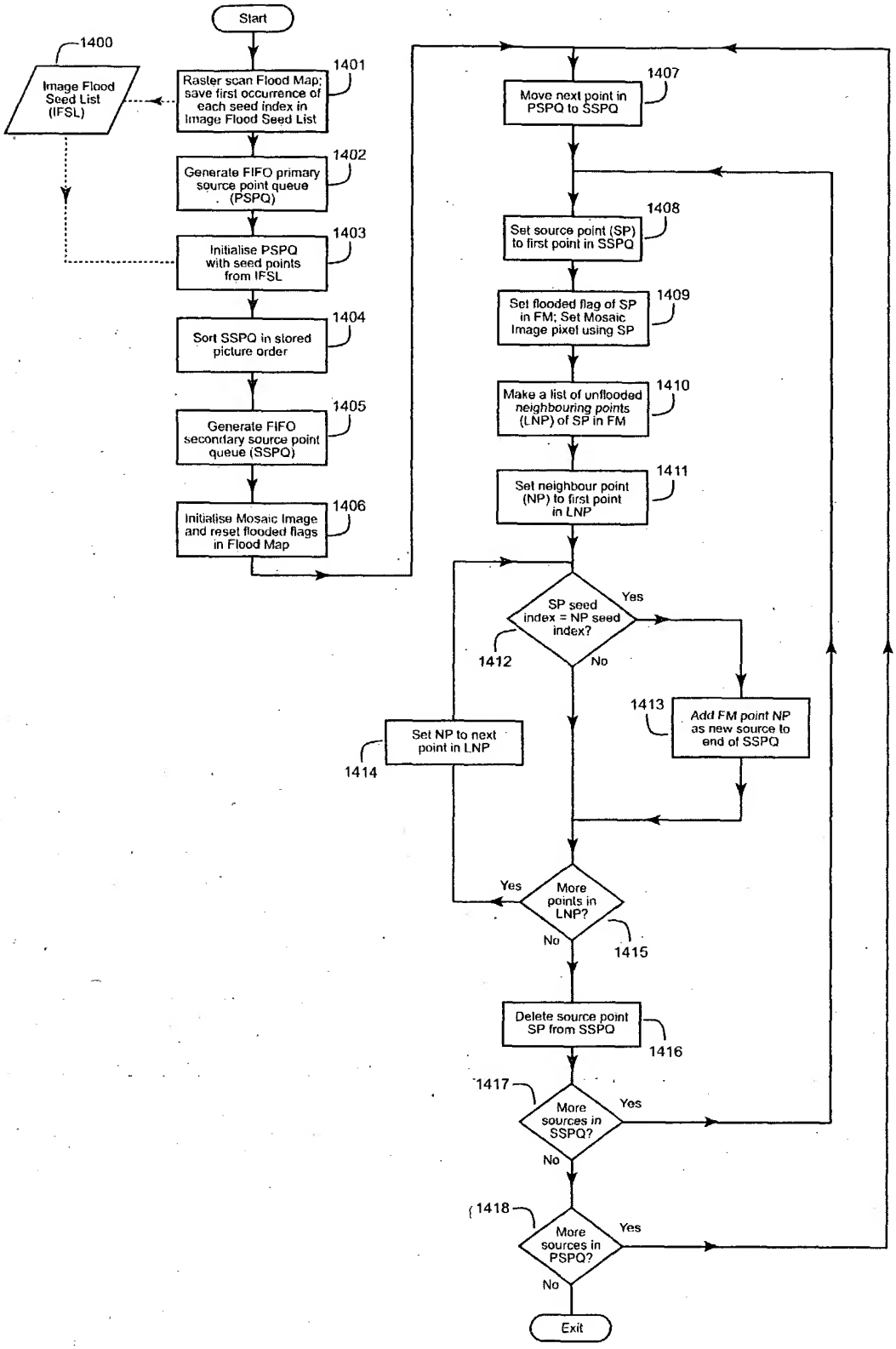

Start
1400
Image Flood Seed List (IFSL)
Raster scan Flood Map; save first occurrence of each seed index in Image Flood Seed List
1401
Generate FIFO primary source point queue (PSPQ)
1402
Initialise PSPQ with seed points from IFSL
1403
Sort SSPQ in stored picture order
1404
Generate FIFO secondary source point queue (SSPQ)
1405
Initialise Mosaic Image and reset flooded flags in Flood Map
1406
Move next point in PSPQ to SSPQ
1407
Set source point (SP) to first point in SSPQ
1408
Set flooded flag of SP in FM; Set Mosaic Image pixel using SP
1409
Make a list of unflooded neighbouring points (LNP) of SP in FM
1410
Set neighbour point (NP) to first point in LNP
1411
SP seed index = NP seed index?
Yes
No
1412
Add FM point NP as new source to end of SSPQ
1413
Set NP to next point in LNP
1414
More points in LNP?
Yes
No
1415
Delete source point SP from SSPQ
1416
1417
More sources in SSPQ?
Yes
No
1418
More sources in PSPQ?
Yes
No
Exit

FIG.14

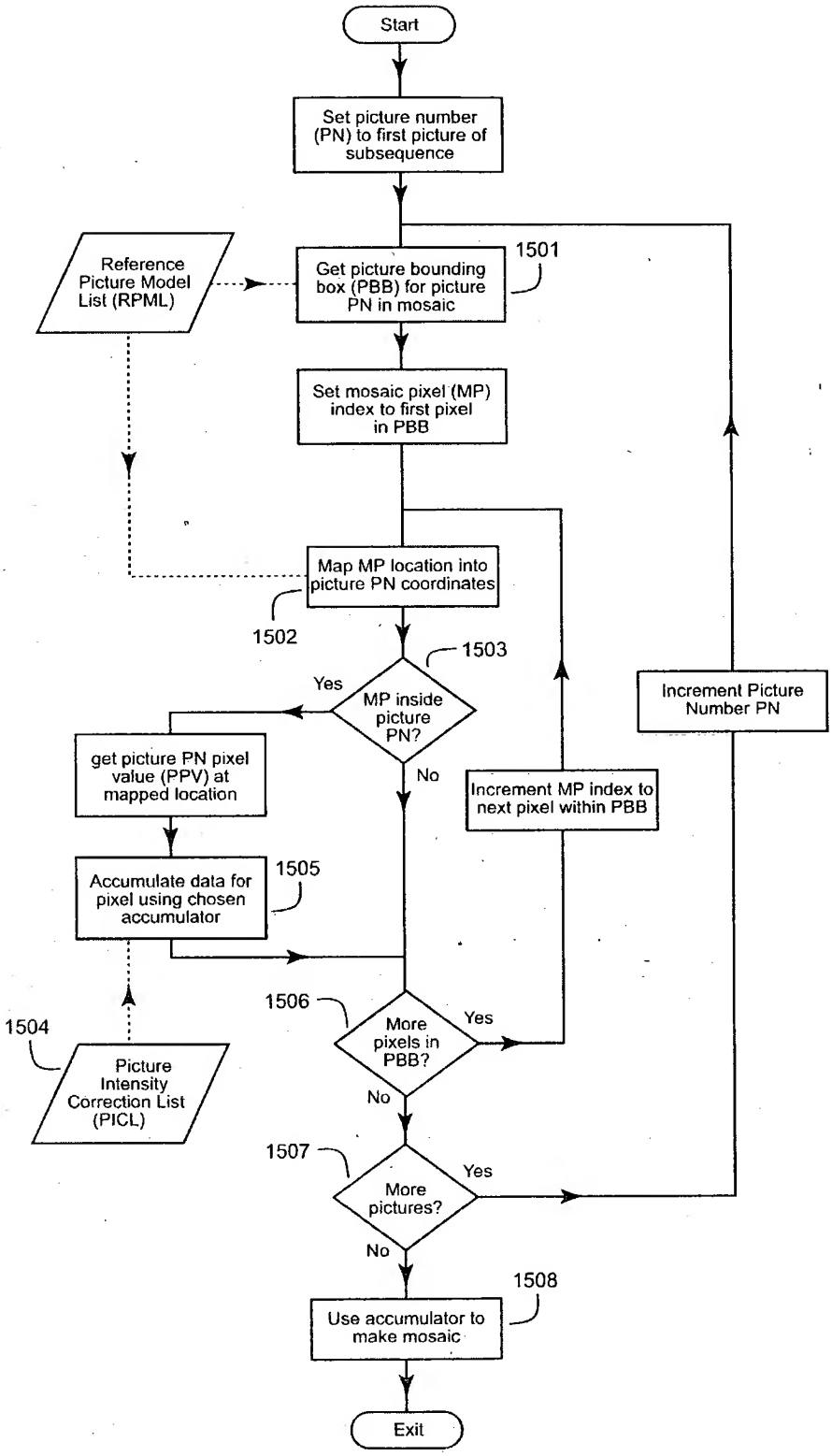

Start
Set picture number (PN) to first picture of subsequence
Reference Picture Model List (RPML)
Get picture bounding box (PBB) for picture PN in mosaic
1501
Set mosaic pixel (MP) index to first pixel in PBB
Map MP location into picture PN coordinates
1502
1503
MP inside picture PN?
Yes
No
get picture PN pixel value (PPV) at mapped location
Accumulate data for pixel using chosen accumulator
1505
Increment MP index to next pixel within PBB
Increment Picture Number PN
1504
Picture Intensity Correction List (PICL)
1506
More pixels in PBB?
Yes
No
1507
More pictures?
Yes
No
1508
Use accumulator to make mosaic
Exit

FIG.15

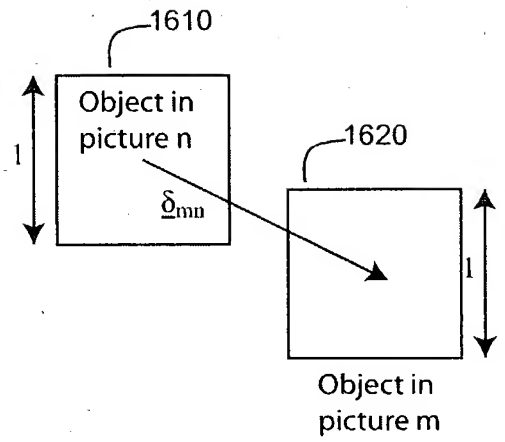

1610
Object in
picture n
l
$\underline{\delta}_{mn}$
1620
l
Object in
picture m

FIG.16

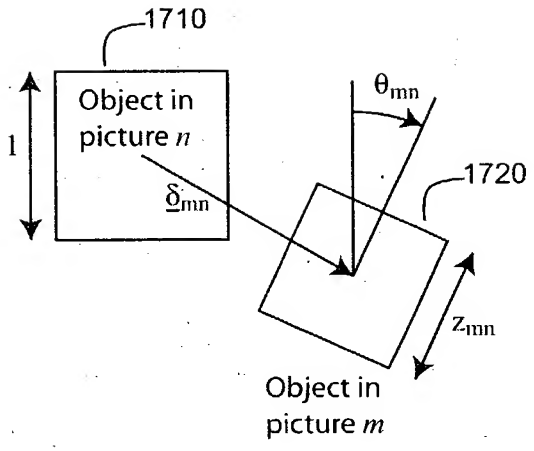

1710
Object in
picture n
l
δmn
θmn
1720
zmn
Object in
picture m

FIG.17

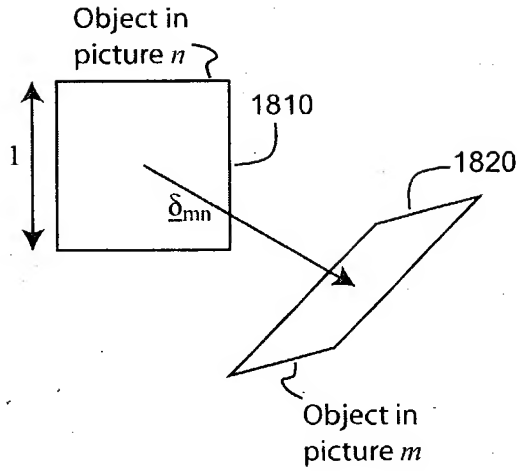

Object in
picture $n$
1810
1
1820
$\underline{\delta}_{mn}$
Object in
picture $m$

FIG.18

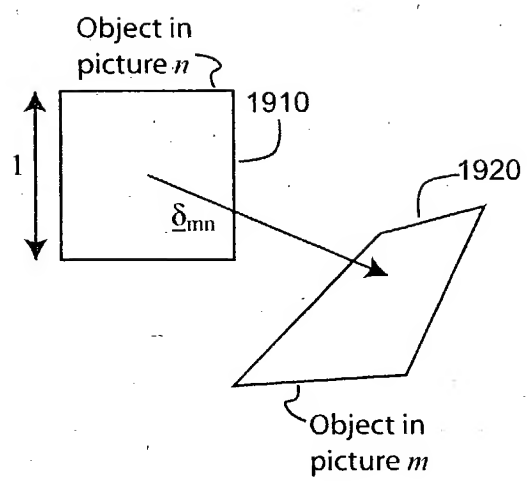



FIG.19

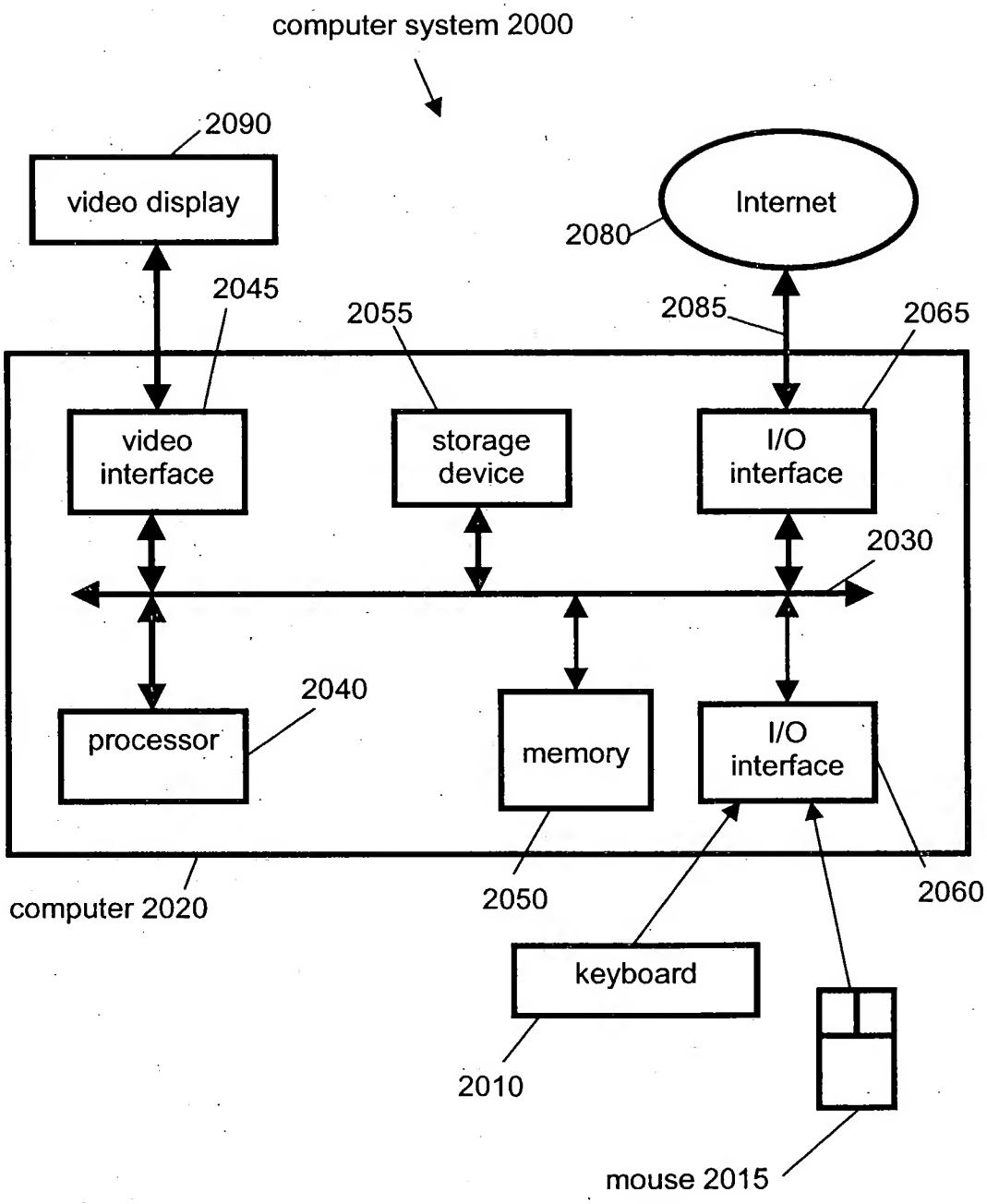

computer system 2000
2090
video display
Internet
2080
2045
2055
2085
2065
video interface
storage device
I/O interface
2030
2040
processor
memory
I/O interface
computer 2020
2050
2060
keyboard
2010
mouse 2015

FIG. 20